MAKING A BUSINESS CASE FOR THE HUMAN FACTORS PROGRAMS IN AVIATION MAINTENANCE

Manoj S. Patankar, Ph.D.
Department of Aviation, San Jose State University
San Jose, CA 95192

James C. Taylor, Ph.D.
School of Engineering, Santa Clara University
Santa Clara, CA 95053

ABSTRACT

A growing challenge to the developers of human factors training programs today is that of financial justification. Most aviation maintenance personnel in the airline industry are aware of human factors issues; however, supervisors and managers continue to be challenged to make a business case for their human factors programs. This paper presents a model for the development of an integrated human factors business plan with return-on-investment calculations. Organizations that have already conducted the training, will find the return-on-investment calculations useful to measure the financial success of their training efforts.

INTRODUCTION

Maintenance Resource Management/ Maintenance Human Factors (MRM/MHF) programs have had numerous different impacts on operations and safety in the aviation industry. Awareness instruction programs at several airlines demonstrated an increase in the employee awareness of, and enthusiasm for, safety issues, reduction in personal injuries and aircraft ground damage incidents, reduction in logbook errors, and openness to other performance enhancements (Taylor & Christensen, 1998 Ch. 9 & 10). Behavior training programs at some corporate aviation departments have shown an increase in the pilot-technician communication, improvements in technical support from third-party service providers, and better cooperation with the local FAA (Patankar & Taylor, 1999). So, there is enough data to demonstrate that MRM programs are successful; yet, this "success" is illusive because a specific MRM program may not necessarily result in the same improvements at all sites. This paper presents a business case in the form of a typical business plan for extant and future MRM programs.

THE BUSINESS PLAN

At the 1998 Advances in Aviation Safety Conference in Daytona Beach, FL, advocates of MRM/MHF programs in the United States expressed a strong need to make a business case for the human factors programs in aviation maintenance. They claimed that unless a specific return-on-investment (ROI) process is presented to the industry executives, the future of MRM/MHF programs was in jeopardy. In response to this invitation, Taylor (In Press) presented an in-depth analysis of ROI for on-going MRM/MHF instruction programs. His analysis acknowledged the presence of parallel efforts, in addition to the formal MRM/MHF instruction, within a company that may be contributing toward improvements in safety. In a subsequent paper, Patankar and Taylor (In Press) introduced the concept of "targeted MRM programs" in which MRM/MHF programs could be tailored to meet a variety of needs and would result in a corresponding variety of outcomes.

Based on these recent developments and our field experience, we strongly suggest that both current and future MRM program managers develop a sound business plan to overcome the historic challenges of "revolving door management" (Patankar and Taylor, 1999b), "merger mania" (Patankar and Taylor, 1998), and "lack of management follow through" (Taylor and Christensen, 1998).

The key elements of a such a business plan, like any other business plan, would be as follows: (a) executive summary, (b) present situation, (c) objectives, (d) management, (e) product/service description, (f) market analysis, (g) marketing strategy, and (h) financial projections.

Executive Summary

The purpose of the executive summary is to give senior executives a quick synopsis of the MRM program including the needs analysis, the mission, the goals and objectives, the unique resources available/required, the scope and timeline, and the financial advantages of implementing this program.

It is imperative that the MRM manager understands the corporate mission and abides by the corporate values for him/her to receive support from the senior management. Kotter (1998) states that one of the main reasons for change programs to fail is that the changes are not anchored in the corporation's culture. If the MRM manager does not align his/her MRM program with the corporate purpose, he/she risks failure.

"With change, the task is to manage the dynamic, not the pieces" (Duck, 1998 p. 57). The HF manager should be able to identify all the components required to make the MRM program successful at his/her airline and then orchestrate these components such that he/she is able to manage the dynamic and not the individual pieces. Such an action requires strong commitment from the CEO or a person who enjoys an incredible amount of political strength in the airline.

For example, the mission of one major airline in the U.S. is "dedication to the highest quality of Customer Service delivered with a sense of warmth, friendliness, individual pride, and Company Spirit." Because this airline so concerned about maintaining its "Company Spirit," its MRM program must incorporate elements that adhere to the Company values like safety and customer service.

To assess the need for the MRM program and to determine the scope of such a program, the MRM manager will find it beneficial to analyze the performance statistics of his/her airline. For example, the financial/productivity losses associated with ground damage incidents, documentation errors, and communication errors during shift turnovers are excellent indications of systemic problems that have the potential of leading to catastrophic failures. Targeting one or more of these issues also provides the MRM manager with the ability to measure safety improvements in terms of reduced incidents (and associated costs) rather than the deceptive "X number of days without an accident."

Present Situation

A brief analysis/synopsis of the current performance or safety data would be helpful in establishing a need for the MRM program.

Aviation accidents are infrequent and cause sudden, large-scale losses, risks cannot be managed effectively by simply tracking the fatal accidents. Performance parameters like the ones listed above (ground damage incidents, documentation errors, etc.) reflect the prevailing safety "climate." If these parameters are tracked as a trend over several months, a more meaningful intervention technique could be launched.

Objectives

Based on a needs analysis and a review of performance data throughout the Company, specific objectives for the MRM program could be developed. But prior to formulating these objectives and the associated time-line/budget, it will be worthwhile to assess the overall strategy.

Patankar and Taylor (In Press) have identified two distinct strategies: attitude change first (awareness instruction) and behavior change first (MRM skills training). Many airlines have initiated their MRM programs with awareness courses. Such instruction is very useful in providing the maintenance community with a common language regarding the human factors concepts. Several studies have shown that awareness programs have been successful in educating the participants regarding the safety issues, and these participants were enthusiastic about wanting to apply this instruction in their work environment (Taylor, 1995; Taylor, *et al.,* 1997). The problem with awareness instruction is that it just affects awareness; however much, the airlines may expect such programs to automatically effect a behavior change beyond the individual. That is an unreasonable expectation. If an airline intends to provide awareness instruction, it should not expect more than a heightened awareness and a readiness to apply more individual care at the workplace. Some corporate aviation departments, on the other hand, have implemented MRM skills training (Patankar and Taylor, 1999a). These programs established specific structures and process to effect department-wide changes that were consistent with the accepted change implementation process. Evaluation of such a strategy indicates that even if the participants (technicians) don't believe in this program at first, they are likely to practice the essential behaviors. As long as the process is successful in effecting systemic changes, an improvement in the participants' attitude usually follows.

Management

In a conventional business plan the expertise of the management personnel responsible for operating the business is delineated in this section of the business plan so that they can establish credibility with the investors. Similarly, for MRM programs, airline management, labor unions, and the local FAA inspectors are encouraged to collaborate such that their program continues to flourish even if it experiences personnel turnover. Through such collaborative activities, all three parties can establish credibility of their MRM program.

Most of the airlines that have an MRM program have several key people who champion the theory and practice of human factors. Often, these champions include local management, trade union leaders, and company educators. Top management is sometimes an active champion, but this is unfortunately rare. Cooperation of both the labor union(s) and all levels of management is crucial. Eiff's (1999) research shows that the first-line supervisors, such as the Lead Mechanics and Foremen, are the most influential people in affecting technician behavior. Therefore, it will be beneficial to seek appropriate Leads and Foremen to champion the implementation of MRM principles.

Product/Service Description

The outcome of an MRM program could be a product, a service, or both. If the airline chooses to provide only the awareness instruction, then the instruction is a product. If the airline creates associated skills training, the exercise of those new skills is a product. When the participants start using these products, they will provide service to their own organization as well as to their external customers. Therefore, the MRM manager must expect both product and service as the outcomes of his/her program.

In addition to the awareness and/or skills training, we suggest that meeting positive goals like the "number of errors avoided" or "number of information discrepancies resolved" become milestones for celebration. Such goals, instead of the conventional "accident-free days," will stimulate an enthusiastic environment wherein people want to actively reduce errors. A banner stating the number of days without an accident simply creates suspense as to when the next one is going to strike because absence of accident does not mean presence of safety.

Market Analysis

In a conventional business plan, this section would provide the details regarding the consumers of the products/services, geographical scope of the market and demographics, growth potential, the organization's ability to satisfy the business demands, and customer retention/growth plans.

From an MRM program's perspective, the plan should identify the consumer group(s) (technicians, maintenance managers, stores personnel, utility or ground service personnel, etc.), whether this is a trial program to be tested at a specific station (including the reasons for choosing that station), "how" and "when" this program may be implemented at other stations, and the way the MRM group plans to handle personnel turnover.

Marketing Strategy

Far too often there are several success stories within an organization that are not communicated to all the stations. In order to multiply the benefits of MRM programs, it is imperative that the successes be communicated through local media such as newsletters or the Company intranet. Similarly, the communication of failures may also be useful, but such communication must be done very carefully and with adequate analysis.

Financial Projections

Depending on whether the MRM program calls for classroom instruction, specific interventions, or both, corresponding financial projections/analysis will be required.

A definition of ROI. In conventional terms, a company's "earnings" are its "income" minus its "expenses" for some fixed period of time. Given that definition of "earnings," ROI is traditionally reported as "earnings" divided by "investment." To further standardize the ROI expression, the resulting quotient is multiplied by 100 to convert it to a percent expression.

ROI from classroom instruction only. Taylor (In Press) cites a ROI model by Phillips (1997) for classroom instruction that converts the "earnings" term into a "net benefit from training." This new model accepts training interventions and it uses the annualized percentage ratio of net program benefits to program costs-- the ROI formula familiar to operating managers and their financial counterparts. Taylor introduces to this model a novel component, the "causal operator" term. This new component is designed to account for the degree of effect the targeted MRM intervention has had on net program benefits (the ROI formula's numerator).

$$MRM\,ROI = \left(\frac{[NetMRM\,Benefits] \times CausalOperator}{MRM\,Costs} \right) \times 100$$

The "causal operator" represents the variance explained by the MRM variable (the human MRM results of attitudes, knowledge, and/or behaviors) in the subsequent safety outcomes. This "causal operator" acts as a quantitative measure for the contribution of MRM to safety in a given period of time.

The effect of this modification to the traditional ROI equation is to reduce the size of net program benefit by a positive factor between zero and one. This reduced size of the net program benefit is a more realistic calculation of the ROI from the MRM intervention alone. In this manner, the reduced net program benefit acknowledges the potential effects of other interventions on the net program benefit.

When Taylor (In Press) tested this new ROI model taking the results (in current dollars) from several actual MRM interventions, using their documented effects on improved safety outcomes, he discovered that in one application, the lost time injuries model yielded a 24 percent ROI and in the other, the ground damage incidents model yielded a negative 42 percent ROI. Both applications used the same MRM cost data that were calculated from the design and implementation of an existing two-day MRM instructional program created at another airline. This means that despite adjusted MRM program costs and a high contribution of the MRM program to the reduced ground damage benefit, the second application failed to pay for itself in two years. The large size of the negative return in that second application is of course a disappointment. It is evidence that a targeted approach to MRM intervention (*cf.,* Patankar & Taylor, in press) is required – an approach in which the approximate value of the anticipated benefits are calculated and understood before an MRM program is launched. Not all reasons for undertaking an MRM program should be financial however. Under some circumstances, either the qualitative results (e.g.,

improved employee morale resulting from working more carefully) or avoiding unlikely, long-term events (e.g., the occurrence of a costly and/or fatal accident because of undocumented and unrepaired damage) are suitable reasons for undertaking and continuing an MRM program.

ROI from specific organizational change interventions: Specific interventions such as instituting roundtable discussions and small group forums to improve logbook documentation (Taylor & Christensen, 1998 Ch. 9) and on-the-job assistance to improve shift turnover briefings (Eiff, 1999) have resulted in some very impressive benefits. Such interventions go beyond the classroom instruction and actually help the participants solve their extant problems using the human factors principles. Eiff mapped the communication processes during shift turnovers at a heavy maintenance facility of a major U. S. airline. He discovered that the Lead Mechanics were at the hub of these communications, but they were not participating in shift briefings. Eiff used a team of four mechanics, four leads, two shift managers, two academic faculty, and three students to compile the shift communication information, cross-check it with the corresponding job descriptions, and develop a new shift turnover process. Eiff's team trained one maintenance bay in using the new procedures and measured their effectiveness. Eiff's results show that after the first aircraft, 58 percent of the people were satisfied with the new shift turnover process and there was an associated decrease in lost productivity from 64 hours to 11 hours. After the second aircraft, 65 percent of the people were satisfied with the new shift turnover process and there was an associated decrease in productivity from the initial 64 hours to 0 hours. In general, Eiff's team was successful in saving $140,000 per aircraft. A natural next step in calculating ROI would be to determine the costs of efforts to change the shift turnarounds and to include those costs in the formula above.

CONCLUSIONS

Return on investment (ROI) formula or model to be used for an MRM program will depend on the specific goals and objectives of that program. This paper has presented ways of calculating the financial benefits or return-on-investment for both classroom instruction as well as specific on-site interventions. However, the formulation of a sound business plan prior to initiating an MRM instruction process is just as crucial to the success and sustenance of MRM program.

Companies that have developed specific MRM targets, must also develop the corresponding measurement tools and techniques. It is best to develop the measurement system concurrent with the strategic plan. For those companies that have not started their MRM programs yet, it will be best to have the strategic goals and evaluation criteria established prior to launching their MRM program. For those companies that have already delivered their MRM instruction, the next step would be to set specific performance/safety goals, develop strategies to accomplish those goals, and then

to achieve those goals. Irrespective of the type of MRM program implemented, there is a positive effect on the safety/performance of that company. It is well established from experience with other programs that senior management will find targeted and cost-justified MRM programs easier to support.

ACKNOWLEDGEMENTS

REFERENCES

Duck, J. D. (1998). Managing change: the art of balancing, *Harvard Business Review on Change* (pp. 55-81). Boston, MA: Harvard Business School Press.

Eiff, G. (1999). *Human factors: safety and productivity equation, and return on investment.* Presented at the 1999 SAE Airframe/Engine Maintenance and Repair Conference. Vancouver, B.C.

Kirkpatrick, D.L. (1975) Techniques for evaluating training programs. *Evaluating Training Programs,* Alexandria, VA: American Society for Training and Development, pp. 1-17.

Kotter, J. (1998). What leaders really do, *Harvard Business Review on Leadership* (pp. 37-60). Boston, MA: Harvard Business School Press.

Patankar, M and Taylor, J (1998). The multi-party world of aircraft maintenance: a case for systemic management and human factors education. *Proceedings of the SAE Airframe/Engine Maintenance and Repair Conference.* Daytona Beech, FL, pp. 15-19.

Patankar, M., & Taylor, J. (1999a). *Corporate aviation on the leading edge: systemic implementation of macro-human factors in aviation maintenance.* Presented at the 1999 SAE General, Corporate & Regional Aviation Meeting & Exposition. Wichita, KS.

Patankar, M., & Taylor J. (1999b). *Human resources integration master plan: a response to revolving door management.* Presented at the Maintenance Human Factors Workshop sponsored by the NTSB. Vancouver, B.C.

Patankar, M & Taylor, J. (In Press). Targeted MRM programs: setting ROI goals and measuring the results. *Proceedings of the SAE Advances in Aviation Safety Conference & Exposition,* Daytona Beach, FL, April 2000.

Phillips, J. (1997). *Return on Investment in Training and Performance Improvement Programs.* Houston, TX: Gulf Publishing Company.

Taylor, J.C. (1995). Effects of communication & participation in aviation maintenance. *Proceedings of the Eighth International Symposium on Aviation Psychology.* Columbus OH: The Ohio State University, pp.472-477.

Taylor, J. (In Press). A new model for measuring return on investment (ROI) for safety programs in aviation: an example from airline maintenance resource management (MRM). *Proceedings of the SAE Advances in Aviation Safety Conference & Exposition,* Daytona Beach, FL, April 2000.

Taylor, J. C., & Christensen, T. (1998). *Airline Resource Management: Improving Communication.* Warrendale, PA: Society of Automotive Engineers.

Taylor, J.C.; Robertson, M.M. & Choi, S. (1997). Empirical Results of Maintenance Resource Management Training for Aviation Maintenance Technicians. *Proceedings of the Ninth International Symposium on Aviation Psychology.* Columbus OH: The Ohio State University, pp.1020-1025.